U.S. Patent No. 3,954,526 to Mangum et al.("Mangum"), U.S. Patent No. 5,020,731 to Somoza et al. ("Somoza I"), and U.S. Patent No. 5,279,492 to Somoza et al. ("Somoza II").

To establish a prima facie case of obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). "All words in a claim must be considered in judging the patentability of that claim against the prior art." *In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970).

Subramaniam is directed to the production of extremely small particles (0.1-10 μm) by using a supercritical anti-solvent. Subramaniam differs from the present invention both in aim and means. It does not teach nor suggest using ultrasound vibration to increase stability and decrease sensitivity of explosives. In addition, Subramaniam discloses that the particle precipitation method **improves reactivity** of explosives (col. 17, line 56). Therefore, Subramaniam actually teaches away from the present invention.

Mangnum discloses a method for making coated ultra-fine ammonium perchlorate particles without grinding. Mangnum does not teach that ultrasonic vibration is essential and, more importantly, it does not mention nor suggest that the application of ultrasonic vibration increase the stability and decrease the sensitivity of the resulting ammonium perchlorate particles.

Somoza I discloses a method for removing occluded acidity from unrecrystallized explosive materials. The method involves an ultrasonic grinding step, which is a process completely different from the claimed process of crystallisation. When applying ultrasonic vibration during grinding, the ultrasonic energy is directed towards the solid particulates which apparently breaks under influence of the ultrasonic energy. When applying ultrasonic vibration during crystallisation, the ultrasonic energy is directed towards the crystallizing mixture where it influences nucleation and crystal growth of the solid particulates. Therefore, it would not be obvious for a person skilled in the art to combine Somoza I with Subramaniam at the time of the

invention. Furthermore, Somoza I does not teach or suggest anything about the stability or sensitivity of the explosive materials prepared by the ultrasonic grinding procedure.

Somoza II discloses that the sensitivity of a particulate energetic material is reduced when the particle size of the particulate energetic material is reduced. However, Somaza II did not disclose anything about the stability of the particulate energetic material. Furthermore, according to the present invention, there is no direct correlation between particle size and sensitivity i.e., the particle morphology (aspect ratio and particle size are both morphology parameters) is not directly linked to the stability and sensitivity (page 3, lines 19-28). It is the claimed crystallisation process, as a whole, that provides the desired features of the crystalline energetic materials.

"When applying 35 U.S.C. 103, the following tenets of patent law must be adhered to: .... The references must be considered as a whole and must suggest the desirability and thus the obviousness of making the combination..." MPEP 2141.

Applicants respectfully submit that Subramaniam, Mangnum and Somoza I do not suggest using ultrasound vibration in a crystallisation process to increase the stability and decrease the sensitivity of crystalline energy materials. Applicants further submit that Somoza II only suggests a correlation between particle size and sensitivity. None of the references mentions the concept of stability after crystallisation. Therefore, considered as a whole, these references do not suggest the desirability and thus the obviousness of making the combination to address the stability issue.

Applicants respectfully request that the rejection of independent claims 1, 9, 14, and 18 be withdrawn and the claims allowed. Applicants respectfully submit that dependent claims 2, 10-12, 15, 16, 20, 21, 23, 25, and 26 are patentable for the reasons provided with respect to claims 1, 9, 14, and 18, and because they define additional combinations of features not found in or suggested by the cited references.

In view of the foregoing remarks, favorable reconsideration of all pending claims is requested. Applicants respectfully submit that this application is in condition for allowance and request that a notice of allowance be issued. Should the Examiner believe that a conference would expedite the prosecution of this application or further clarify the issues, the Examiner is encouraged to contact Applicants' attorney at the telephone number listed below.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

1. (Twice Amended) A process for the production of crystalline energetic materials [***having improved stability and/or decreased sensitivity by crystallisation of raw energetic materials***], comprising:

preparing a crystallising mixture containing [***the***] raw energetic materials;

subjecting the crystallising mixture to ultrasonic vibration during crystallization; and

harvesting the crystalline energetic materials,

wherein the ultrasonic vibration has a frequency of between 10 and 100 kHz, and results in a zone of ultrasonic vibration in the crystallising mixture**, and**

wherein the crystalline energetic materials have increased stability and decreased sensitivity with respect to the raw energetic materials.

9. (Twice Amended) A process for the production of crystalline energetic materials [***having improved stability and/or decreased sensitivity by crystallisation of raw energetic materials***], comprising:

preparing a crystallising mixture containing [***the***] raw energetic materials; [***and***]

subjecting the crystallising mixture to ultrasonic vibration during crystallization; and

harvesting the crystalline energetic materials,

wherein the ultrasonic vibration has a frequency of between 10 and 100 kHz, and results in a zone of ultrasonic vibration in the crystallising mixture,

wherein the crystallising mixture is stirred during crystallisation, and is passing through the zone of ultrasonic vibration continuously**, and**

wherein the crystalline energetic materials have increased stability and decreased sensitivity with respect to the raw energetic materials.

14. (Twice Amended) A process for the production of crystalline energetic materials [***having improved stability and/or decreased sensitivity by crystallisation of raw energetic materials***], comprising:

preparing a crystallising mixture containing [***the***] raw energetic materials; [***and***]

subjecting the crystallising mixture to ultrasonic vibration during crystallization; and

harvesting the crystalline energetic materials,

wherein the ultrasonic vibration has a frequency of between 10 and 100 kHz, and results in a zone of ultrasonic vibration in the crystallising mixture,

wherein the crystallising mixture is stirred during crystallisation, and is passing through the zone of ultrasonic vibration continuously,

wherein the temperature during crystallisation is between 15 and 75°C,

wherein the ultrasonic vibration is generated using an ultrasonic probe having an amplitude between 0.4 and 10 μm**, and**

wherein the crystalline energetic materials have increased stability and decreased sensitivity with respect to the raw energetic materials.

18. (Twice Amended) A process for the production of crystalline energetic materials [***having improved stability and/or decreased sensitivity by crystallisation of raw energetic materials***], comprising:

preparing a crystallising mixture containing [***the***] raw energetic materials; [***and***]

subjecting the crystallising mixture to ultrasonic vibration during crystallization; and

harvesting the crystalline energetic materials,

wherein the ultrasonic vibration has a frequency of between 10 and 100 kHz, and results in a zone of ultrasonic vibration in the crystallising mixture,

wherein the crystallising mixture is stirred during crystallisation, and is passing through the zone of ultrasonic vibration continuously,

wherein the temperature during crystallisation is between 15 and 75°C,

wherein the ultrasonic vibration is generated using an ultrasonic probe having an amplitude between 0.4 and 10 μm,

wherein the raw energetic materials are selected from a group consisting of explosives and high energy oxidizers**, and**

wherein the crystalline energetic materials have increased stability and decreased sensitivity with respect to the raw energetic materials.

PENDING CLAIMS

1. (Twice Amended) A process for the production of crystalline energetic materials, comprising:

preparing a crystallising mixture containing raw energetic materials;

subjecting the crystallising mixture to ultrasonic vibration during crystallization; and

harvesting the crystalline energetic materials,

wherein the ultrasonic vibration has a frequency of between 10 and 100 kHz, and results in a zone of ultrasonic vibration in the crystallising mixture, and

wherein the crystalline energetic materials have increased stability and decreased sensitivity with respect to the raw energetic materials.

2. (Amended) The process of claim 1, wherein the crystallising mixture is stirred during crystallisation.

9. (Twice Amended) A process for the production of crystalline energetic materials, comprising:

preparing a crystallising mixture containing raw energetic materials;

subjecting the crystallising mixture to ultrasonic vibration during crystallization; and

harvesting the crystalline energetic materials,

wherein the ultrasonic vibration has a frequency of between 10 and 100 kHz, and results in a zone of ultrasonic vibration in the crystallising mixture,

wherein the crystallising mixture is stirred during crystallisation, and is passing through the zone of ultrasonic vibration continuously, and

wherein the crystalline energetic materials have increased stability and decreased sensitivity with respect to the raw energetic materials.

10. (Amended) The process of claim 9, wherein the temperature during crystallisation is between 15 and 75°C.

11. (Amended) The process of claim 1, wherein the temperature during crystallisation is between 15 and 75°C.

12. (Amended) The process of claim 2, wherein the temperature during crystallisation is between 15 and 75°C.

14. (Twice Amended) A process for the production of crystalline energetic materials, comprising:

preparing a crystallising mixture containing raw energetic materials;

subjecting the crystallising mixture to ultrasonic vibration during crystallization; and

harvesting the crystalline energetic materials,

wherein the ultrasonic vibration has a frequency of between 10 and 100 kHz, and results in a zone of ultrasonic vibration in the crystallising mixture,

wherein the crystallising mixture is stirred during crystallisation, and is passing through the zone of ultrasonic vibration continuously,

wherein the temperature during crystallisation is between 15 and 75°C,

wherein the ultrasonic vibration is generated using an ultrasonic probe having an amplitude between 0.4 and 10 µm, and

wherein the crystalline energetic materials have increased stability and decreased sensitivity with respect to the raw energetic materials.

15. (Amended) The process of claim 1, wherein the ultrasonic vibration is generated using an ultrasonic probe having an amplitude of between 0.4 and 10 µm.

16. (Amended) The process of claim 2, wherein the ultrasonic vibration is generated using an ultrasonic probe having an amplitude of between 0.4 and 10 µm.

18. (Twice Amended) A process for the production of crystalline energetic materials, comprising:

preparing a crystallising mixture containing raw energetic materials;

subjecting the crystallising mixture to ultrasonic vibration during crystallization; and

harvesting the crystalline energetic materials,

wherein the ultrasonic vibration has a frequency of between 10 and 100 kHz, and results in a zone of ultrasonic vibration in the crystallising mixture,

wherein the crystallising mixture is stirred during crystallisation, and is passing through the zone of ultrasonic vibration continuously,

wherein the temperature during crystallisation is between 15 and 75°C,

wherein the ultrasonic vibration is generated using an ultrasonic probe having an amplitude between 0.4 and 10 μm,

wherein the raw energetic materials are selected from a group consisting of explosives and high energy oxidizers, and

wherein the crystalline energetic materials have increased stability and decreased sensitivity with respect to the raw energetic materials.

20. (Amended) The process of claim 1, wherein the raw energetic materials are selected from a group consisting of explosives and high energy oxidisers.

21. (Amended) The process of claim 2, wherein the raw energetic materials are selected from a group consisting of explosives and high energy oxidisers.

23. (Amended) The process of claim 18, wherein the raw energetic materials are selected from a group consisting of hydrazinium nitroformate, CL-20, ADN, AP, RDX, HMX and PETN.

25. (Amended) The process of claim 1, wherein the said energetic materials are selected from a group consisting of hydrazinium nitroformate, CL-20, ADN, AP, RDX, HMX and PETN.

26. (Amended) The process of claim 2, wherein the said energetic materials are selected from a group consisting of hydrazinium nitroformate, CL-20, ADN, AP, RDX, HMX and PETN.